Reservoir that occur during winter and spring months are beneficial in sustaining gravel recruitment, transport and cleaning processes. Late non-flood control releases during the winter and/or early-spring period flow will be maintained at levels events of sufficient magnitude to attract and sustain adult steelhead and American shad spawning runs. Moreover, spring and early summer flows will be maintained at levels that provide sufficient physical space for improve transport of juvenile salmon, steelhead, and shad rearing as well as favorable downstream migration conditions. Both high-level flood-control releases and lower base-flow releases from reservoir storage during winter and spring will be managed within the operational constraints of the reservoir to sustain riparian habitats and sustain gravel recruitment, transport, and cleansing processes. Sufficient minimum

flows are necessary to maintain adequate conditions for adult holding, spawning, egg incubation, and juvenile rearing and migration, especially because these functions must now occur below Nimbus Dam. The target minimum flows (Table 8) are consistent with historic and unimpaired flows for the American River in dry and normal years that, in some years, may not occur under the present level of project development and operation.

Opportunity to succeed in providing optimum, rather than minimum, flows will rely on collaborative efforts that include stakeholder groups such as the American River Water Forum, State and federal agencies, and local governments. Developing a long-term water management plan for the American River will meet a diversity of needs, including providing streamflows needed to maintain ecological processes and functions; maintaining habitats; and supporting restoration of chinook salmon, steelhead, and other anadromous and resident fish populations below Nimbus Dam. This plan may involve options presently being considered by the American River Water Forum, including diverting water from near the mouth of the river or at the Fairbairn Water Treatment Plant, rather than from Nimbus Dam, or Fairbairn Water Treatment Plant to meet the needs of water users. Opportunities for adjusting seasonal streamflow and carryover storage patterns to benefit fish and lower American River habitats, while maintaining other beneficial uses, will be explored. These opportunities may include acquiring water rights from willing sellers or developing supplemental supplies (e.g., conjunctive use and/or recycled water programs).

The target level of the flow events must be implemented conservatively because of the potential impact on water supply. If a flow event equal to or greater than the target flow has not taken place during uncontrolled releases from Folsom Dam by March, then supplementing base flows or augmenting small, natural flow events or reservoir spills with additional reservoir releases is the only means to provide the necessary flows. Such releases would be allowed only if an equivalent or greater inflow to Folsom Lake occurs. Flow fluctuations within the range of 1,000 to 4,000 cfs can desiccate redds and fluctuations within the range of 3,000 to 10,000 cfs can strand juvenile salmon and steelhead in pools that become isolated from the main channel. Flow reduction criteria (ramping rates) need to be implemented to minimize this problem.

March through May is the logical period during which to provide such flow events because this is the period when natural flow events occurred historically in dry and normal years, and because opportunities for such flow to occur naturally as a function of normal project operation would have passed. Forecasts regarding the water-year type (dry or normal) would also be available by February or March and will be used as the basis for decisions that balance fishery flows with water-supply needs.

The March flow event would be expected to travel unimpaired to the Delta because few if any diversions from the American and Sacramento Rivers occur during March. (Note that additional flow events are prescribed for the Feather and Sacramento Rivers in March, which will further enhance Sacramento River flows below the confluence with the American River.) A March flow event would also help satisfy Delta outflow requirements. Further, the prescribed flow event in late April and early May would add to flow events prescribed from the Mokelumne, Stanislaus, Tuolumne, and Merced rivers to the south, which together will also satisfy Delta outflow requirements.

These prescribed flows cannot usurp individual water rights established subject to California law. ERPP does not include any adjudication or involuntary reallocation of water rights.

Managing for appropriate seasonal flow regimes in the lower American River and American Basin creeks will restore and sustain anadromous and resident fish populations, help promote natural channel formation processes, establish and maintain riparian vegetation, and will sustain numerous foodweb functions. Minimum flows also attract adult steelhead and fall-run chinook salmon during fall and winter.

COARSE SEDIMENT SUPPLY

TARGET 1: Maintain, improve, or supplement gravel recruitment and natural sediment transport in the lower American River and American Basin watersheds to maintain natural ecological processes linked to stream channel maintenance, erosion and deposition, maintenance of fish spawning areas, and the regeneration of riparian vegetation (◆◆).

PROGRAMMATIC ACTION 1A: Monitor spawning gravel conditions in the lower American River and American Basin watersheds, and identify specific sites where mechanical cleaning or gravel introductions would be beneficial to enhance or increase gravel spawning habitat.

PROGRAMMATIC ACTION 1B: Implement a pilot study to assess the benefits of mechanical cleaning to improve gravel permeability.

PROGRAMMATIC ACTION 1C: Develop a collaborative program to investigate erosion, bedload movement, sediment transport, and depositional processes and their relationship to the formation of point bars and riparian regeneration in the lower American River and American Basin watersheds.

RATIONALE: *Gravel is an essential element of spawning and rearing habitats for salmon, steelhead trout, and other native fishes. Gravel supplies are not thought to currently limited salmonid production in the lower American River but may become limiting in the near future, especially in the area immediately below Nimbus Dam. Some gravel is provided naturally when the river cuts into dredger tailings during high flows; however, this input is not sufficient to maintain high quality spawning habitat for the target levels of naturally produced fall-run chinook salmon and steelhead. Gravel recruitment can be supplemented by providing additional gravel for the river to capture under its controlled flow regime.*

The Lower American River Technical Team reported that the availability of spawning habitat does not appear to be an immediate problem as there are adequate amounts of appropriately sized gravel in the river; and there is a large amount of gravel along the banks and in the bars of the lower American River that provide sources for gravel recruitment.

Simply adding gravel to the stream channel may not improve spawning conditions because an impermeable clay lens under the deposited gravel could limit upward percolation and , therefore, fish use for spawning., and other site-specific habitat characteristics. Hence, the specific river location were gravel deposition occurs will largely dictate the benefits to fishery resources of deposition gravel.

Natural sediment supply from the watershed above Folsom Dam has been eliminated. The long-term adverse effects of this have not been adequately investigated. Lack of sediment recruitment from the upper watersheds, ranging from fine sands to cobbles, may adversely influence the structural characteristics of the stream channel, impair riparian and riverine aquatic habitats, and reduce habitat complexity required by anadromous and resident fish species. Investigations into these issues will provide additional insight into finer resolution of long-term opportunities to improve the ecological health of the American River.

The sediment regimes of American Basin creeks have not been investigated. However, because these streams do not have dams on them, natural sediment supplies are probably available. The condition of the watershed and spawning habitats in the upper watersheds of Coon Creek, Auburn Ravine, and Dry Creek should be investigated.

NATURAL FLOODPLAIN AND FLOOD PROCESSES

TARGET 1: Maintain the existing stream meander configuration along the American River between Nimbus Dam and the Sacramento River (◆).

PROGRAMMATIC ACTION 1A: Maintain a stream meander configuration along the lower American River by working with involved parties to develop a floodplain management program consistent with flood control needs. These parties include the Corps, the California Reclamation Board, the Sacramento Area Flood Control Agency, the Lower

American River Task Force, and the American River Water Forum.

PROGRAMMATIC ACTION 1B: Where possible, maintain mainstem and side channel habitats typical of a natural river that provide salmon and steelhead spawning and rearing habitat.

TARGET 2: Restore natural stream meanders in the floodplains of American Basin creeks (◆).

PROGRAMMATIC ACTION 2A: Where possible within flood control constraints, restore natural meander belts along the lower creeks through setback of levees or removal of bank protection, or other physical structures impeding a natural meander process.

TARGET 3: Maintain and enhance floodplain overflow areas in the lower American River and floodplain of the American Basin (◆◆).

PROGRAMMATIC ACTION 3A: Setback levees in the floodplains of creeks and canals of the American Basin.

PROGRAMMATIC ACTION 3B: Protect existing overflow areas from future reclamation.

PROGRAMMATIC ACTION 3C: Develop floodway detention basins in the floodplains of the American Basin to temporarily store floodwaters.

PROGRAMMATIC ACTION 3D: Enter into agreements with willing landowners and irrigation districts to set back levees and allow floodplain processes such as stream meander belts.

PROGRAMMATIC ACTION 3E: Expand existing floodplain overflow basins by obtaining easements of titles from willing sellers of floodplain lands.

PROGRAMMATIC ACTION 3F: Reduce or eliminate gravel mining from active stream channels.

RATIONALE: *Natural river floodplain processes permit natural stream-channel development that supports for riparian vegetation and provides spawning and rearing habitat for chinook salmon and steelhead. Natural stream processes in alluvial systems transport and deposit sediments; provide transient habitats important to algae, aquatic invertebrates, and fish; and provide surfaces colonized by natural vegetation that support wildlife. Overbank flooding is an important regenerative process needed to maintain riparian forests and woodlands. In addition, much of the nutrient input is derived from infrequent overbank flooding of the riparian/floodplain zone. Opportunities to restore floodplains and flood processes along the lower American River are constrained by the flood control requirements provided by Folsom Dam and the levee system throughout in the lower river reach. Adaptive management including focused research and monitoring will be important elements to guide the level to which floodplain processes can be maintained and restored in the lower American River. These processes are closely linked to maintaining and restoring the riparian corridor which supports a variety of aquatic and terrestrial species.*

Remnant effects of devastating dredger mining along the American River also hinder natural stream-channel processes. Because of these constraints, artificial means are necessary to maintain natural stream-channel processes that will provide the habitats needed by salmon and steelhead normally created by these processes.

In the American Basin project levees channel flows in lower creeks into the NCC and NEMDC, which carry floodwaters to the Sacramento River. Levees along the lower creeks typically fail to hold back water as water backs up at the Sacramento River. Widening the floodplain and setting back levees along the NCC, NEMDC, and lower creeks provides more flood carrying capacity and a more natural floodplain process that would promote riparian and wetland habitat development.

CENTRAL VALLEY STREAM TEMPERATURES

TARGET 1: Maintain lower American River water temperatures in the spawning and rearing reach between Arden Bar and Nimbus Dam at or below 60°F beginning as early in October as possible, based on annual coldwater pool availability and maintain water temperatures in the upper portion of the reach between Nimbus Dam and Sunrise Bridge below 65°F from spring through fall (◆◆◆).

PROGRAMMATIC ACTION 1A: Optimally manage Folsom Reservoir's coldwater pool via real-time operation of the water-release shutters to provide the maximum equitable thermal benefits to lower American River steelhead and chinook salmon

throughout the year, within the constraints of reservoir coldwater pool availability.

PROGRAMMATIC ACTION 1B: Reconfigure Folsom Dam shutters to improve management of Folsom Reservoir's coldwater pool and maintain better control over the temperature of water released downstream.

PROGRAMMATIC ACTION 1C: Install a temperature control device on the municipal water intakes at Folsom Dam.

PROGRAMMATIC ACTION 1D: Investigate opportunities to improve the manner in which the water-release shutters at Folsom Dam are physically installed, removed, and maintained annually, as well as opportunities to improve their efficiency in releasing water from desired elevations.

PROGRAMMATIC ACTION 1E: Evaluate the potential for creating side-channels thermal refuges for juvenile steelhead rearing over-summer in the lower American River. Such habitat could provide habitat slightly cooler than peak daytime river temperatures.

PROGRAMMATIC ACTION 1F: Evaluate options to reduce releases of warmer surface waters of Lake Natoma through the turbines at Nimbus Dam into the lower American River. Options may include a temperature curtain in the lake near the turbine intakes. Operations of Nimbus Dam during occasional spill events should also be evaluated to minimize the release of warm surface waters from Lake Natoma.

PROGRAMMATIC ACTION 1G: Provide a more direct supply of colder water to Nimbus Hatchery.

TARGET 2: Maintain a daily average water temperature below 65°F from June 1 through September 30 in the lower American River between Nimbus Dam and Watt Avenue and in the upper portions of Coon Creek, Dotry Creek, Auburn Ravine, Miners Ravine, and Secret Ravine in the American Basin (◆◆).

PROGRAMMATIC ACTION 2A: Evaluate means of maintaining cool water temperatures as necessary in upper watersheds of Coon Creek, Auburn Ravine, and Dry Creek, including such measures as pumping ground water, enhancing riparian vegetation, reducing drainage inputs of warm water from agriculture and urban runoff, and supplementing creek flows with diversions of waters from the Bear and American River Basins.

RATIONALE: *SAFCA used an iterative modeling approach to develop a monthly target release temperature regime on the Lower American River (as part of the DEIR/EIS for P.L. 101-514 CVP Water Supply Contracts). This effort developed a monthly target release temperature regime that mitigated project-related potential water temperature impacts of steelhead and also reduces average annual early life stage mortality for chinook salmon. Modeling analyses revealed that managing Folsom Reservoir's coldwater pool in this alternative manner would: (1) provide water temperatures during the July through September period that would be lower than those realized under the Base Case condition, thereby providing more favorable conditions for over-summering juvenile steelhead; and (2) reduce average annual early life stage losses of chinook salmon caused by elevated Lower American River water temperature during September, October, and November.*

Improved operation of the water-release shutters configuration at Folsom Dam can reduce the temperature of water released into the lower American River. Improved temperatures of water released from Folsom Dam and improved channel habitats are needed to provide adequate over-summer rearing habitat for juvenile steelhead. Releases from Folsom Reservoir's coldwater pool are also required to provide adequate spawning temperatures for fall-run chinook salmon in October and November. However, the low end-of-year storage levels allowed in Folsom Reservoir currently for flood-control purposes will make temperature control for salmon spawning difficult in late summer and early fall of most water-years.

While managing the cold-water pool in Folsom Lake is a priority for maintaining cool water temperatures in the lower American River, lessor but significant benefits can also attained by managing releases from Nimbus Dam. Surface waters (top several feet) of Lake Natoma can heat up to 5 to 10°F from late spring through early fall. Water released into the lower American could be 1 to 2°F lower if warmer surface waters were not included in releases. Because summer temperatures often reach near or above 65°F, 1 to 2°F additional heating is significant. On rare

occasions when water from Lake Natomas spills from the spillways rather than coming from the turbines, an even greater proportion of warmer surface waters from the lake can be released to the river.

Installing a temperature control device at the municipal water supply intake, which is the lowest outlet at Folsom Dam, would allow water from higher elevations of the reservoir to be diverted for municipal purposes, which would preserve the reservoir's cold water pool for releases to the lower American River. The device, which is estimate to cost about $3 million, was authorized by Congress in 1998, but funding was not appropriated.

The Nimbus Hatchery water supply does not provide sufficiently cool water at times during the summer months, and this creates disease problems for steelhead in the hatchery. On occasion, water temperatures are so high that all fish must be removed from the hatchery and transported to nearby hatcheries for rearing. Hatchery temperature requirements can also conflict with Folsom Reservoir cold water pool management for in-river salmonids. When cool water is released for the hatchery, it requires that the entire amount being released to the river be at the desired hatchery temperature even though the hatchery uses a very small portion of the flow. This can exhaust the cold water pool before the end of the summer.

The upper watersheds of the American Basin have historically provided sufficiently cool water to sustain naturally produced rainbow trout/steelhead through the summers. Protecting and enhancing remaining cool water habitat is an essential element of restoring steelhead to these watersheds.

To some degree, high water temperatures in summer and fall in the lower American River are natural; in part, they are a consequence of impaired stream-channel configurations that do not provide shaded side channels with cool groundwater flows. Coldwater releases from the dams and improved channel habitats are needed to provide adequate over-summer rearing habitat for juvenile steelhead.

HABITATS

SEASONAL WETLAND HABITAT

TARGET 1: Protect and enhance 5,150 acres of seasonal wetland habitat acreage in the American Basin consistent with the objectives of the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan (◆◆).

PROGRAMMATIC ACTION 1A: Protect 2,000 acres of existing wetland habitat through fee acquisition and perpetual conservation easements.

PROGRAMMATIC ACTION 1B: Enhance 3,150 acres of existing wetlands.

RATIONALE: *Seasonal wetlands habitats include rice fields and vernal pools, both of which are prevalent in the American Basin. Seasonal wetland habitats provide unique micro habitat conditions that are utilized by fish for spawning and rearing, provide nesting and feeding habitat for waterfowl and wading birds, and provide otters and other mammals with suitable mating, feeding, and rearing habitats. Wetland/slough habitats increase the overall complexity of the aquatic environment, thereby supporting more diverse foodwebs and more diverse fish and wildlife communities. Expansion of seasonal wetlands is important in the Central Valley and American Basin, because much of such habitat has been lost to land reclamation for agriculture and urban development.*

RIPARIAN AND RIVERINE AQUATIC HABITAT

TARGET 1: Establish and/or maintain a sustainable continuous, sustainable corridor of riparian habitat along the lower American River and American Basin creeks (◆◆).

PROGRAMMATIC ACTION 1A: Develop riparian corridor restoration and management plans for the American Basin and lower American River.

PROGRAMMATIC ACTION 1B: Protect riparian habitat along water courses of the American Basin.

PROGRAMMATIC ACTION 1C: Plant riparian vegetation along water courses of the American Basin.

PROGRAMMATIC ACTION 1D: Reduce land use practices such as livestock grazing and watering along stream channels of the American Basin that cause degradation of riparian habitat.

TARGET 2: Enhance shaded riverine aquatic habitat in American Basin creeks and drainage canals

and ditches and along the lower American River (◆◆◆).

PROGRAMMATIC ACTION 2A: Terminate or modify current programs that remove woody debris from the river and creek channels.

PROGRAMMATIC ACTION 2B: Restore side-channels along the lower American River to provide additional riparian corridors for increasing fish and wildlife habitat.

PROGRAMMATIC ACTION 2C: Improve levee management practices to protect and enhance riparian and SRA habitat.

RATIONALE: *Many species of wildlife, including several species listed as threatened or endangered under the State and federal Endangered Species Acts and several special-status plant species in the Central Valley, are dependent on or closely associated with riparian habitats. These habitats support a greater diversity of wildlife species than all other habitat types in California. Degradation and loss of riparian habitat have substantially reduced the habitat area available for associated wildlife species. In addition, loss of this habitat has reduced water storage and has altered nutrient cycling, and foodweb support functions. Controlled flows, lack of gravel recruitment, stream-channel confinement by the flood control system, and remnant dredger tailings limit the possible extent of a natural riparian corridor along the lower American River. Constructing and maintaining restored riparian habitats would improve the habitat needed by fish and wildlife dependent upon the river ecosystem.*

FRESHWATER FISH HABITAT AND ESSENTIAL FISH HABITAT

TARGET 1: Maintain and improve existing freshwater fish habitat and essential fish habitat through the integration of actions described for ecological processes, habitats, and stressor reduction or elimination (◆◆).

PROGRAMMATIC ACTIONS: No additional programmatic actions are recommended.

RATIONALE: *Freshwater fish habitat and essential fish habitat are evaluated in terms of their quality and quantity. Actions described for American River Basin Ecological Zone ecological processes, stressor reduction, and riparian and riverine aquatic habitat should suffice to maintain and restore freshwater fish habitats. For example, maintaining freshwater and essential fish habitats is governed by actions to maintain streamflow, improve coarse sediment supplies, maintain stream meander, maintain or restore connectivity of streams in this zone and their floodplains, and in maintaining and restoring riparian and riverine aquatic habitats.*

PERENNIAL GRASSLANDS

TARGET 1: Restore perennial grasses in the American Basin Ecological Management Unit associated with existing or proposed wetlands (◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to restore perennial grasslands by acquiring conservation easements or purchasing land from willing sellers.

RATIONALE: *Restoring wetland, riparian, and adjacent upland habitats in association with aquatic habitats is an essential element of the restoration strategy for this Ecological Management Zone. Eliminating fragmentation and restoring connectivity will enhance habitat conditions for special-status species.*

AGRICULTURAL LANDS

TARGET 1: Restore and maintain migration corridors (◆).

PROGRAMMATIC ACTION 1A: Purchase land or conservation easements from willing sellers on which to restore wildlife habitat to connect existing grassland or agricultural wildlife habitat.

TARGET 2: Enhance 20,948 acres of private agricultural land to better support nesting and wintering waterfowl consistent with the objectives of the Central Valley Habitat Joint Venture and the North American Waterfowl Management Plan (◆◆).

PROGRAMMATIC ACTION 2A: Develop cooperative programs with farmers to conduct wildlife friendly practices.

RATIONALE: *Corridors of habitat are necessary between larger habitat areas to ensure potential recovery of giant garter snake and other wildlife. Waterfowl and wildlife using wetlands and aquatic habitats depend on adjoining agricultural lands for*

foraging and cover.

STRESSORS

WATER DIVERSIONS

TARGET 1: Reduce losses of juvenile salmon and steelhead in the lower American River and American Basin creeks due to entrainment at water intakes structures (◆◆◆).

PROGRAMMATIC ACTION 1A: Upgrade the fish screens at the Fairbairn Water Treatment Plant to comply with DFG and NMFS fish screening criteria.

PROGRAMMATIC ACTION 1B: Screen diversions from the NCC, NEMDC, Dry Creek, Coon Creek, and Auburn Ravine that operate during times when salmon and steelhead juveniles would be present.

RATIONALE: *Diversion, storage, and release of water directly affect fish, aquatic organisms, and nutrient levels in the system and indirectly affect habitat, foodweb productivity, and the abundance and distribution of species. Diversions cause consumptive loss of water, nutrients, sediment, and organisms juvenile anadromous fishes of management concern. Hence, reducing such losses will contribute to increasing anadromous fish populations of the Central Valley.*

LEVEES, BRIDGES, AND BANK PROTECTION

TARGET 1: Reduce the adverse affect of levees and bank protection on aquatic and terrestrial species and their habitats along the lower American River and American Basin canals and creeks (◆◆).

PROGRAMMATIC ACTION 1A: Identify locations in the lower American River and American Basin creeks and canals where existing revetments could be modified to incorporate habitat features such as scalloped embayments and associated hard points, multi-stage bench areas, SRA habitat, and other features to aid in preservation and/or reestablishment of both berm and bank vegetation.

RATIONALE: *Riprap reduces the ability of vegetation to colonize river banks and, thereby reduces shading of river waters, decreases insect production and availability to fishes, reduces habitat complexity and diversity, and reduces instream cover.*

INVASIVE RIPARIAN AND MARSH PLANT SPECIES

TARGET 1: Reduce populations of invasive non-native plant species that compete with the establishment and succession of native riparian vegetation along the American River. This will help to reestablish native riparian vegetation in floodplains, increase SRA cover for fish, and increase habitat values for riparian-associated wildlife (◆◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to monitor the distribution and abundance of non-native plants and develop cooperative control programs as needed.

RATIONALE: *Non-native plant species, such as false bamboo, salt cedar, eucalyptus, water hyacinth, and pepperweed, can undermine riparian habitat value to fish and wildlife, as well as the natural plant succession that contributes to the physical character of the riparian corridors. Arundo has become established in the American River floodway and can seriously alter ecological processes by inducing greater deposition of sediments, increasing evapotranspiration, and altering soil chemistry. Arundo has little value for native species of wildlife and outcompetes native riparian plant species.*

HARVEST OF FISH AND WILDLIFE

TARGET 1: Develop harvest management strategies for Central Valley chinook salmon and steelhead populations that allow populations of naturally spawned fish to attain levels that fully use existing and restored habitat (◆◆◆).

PROGRAMMATIC ACTION 1A: Control illegal harvest of chinook salmon and steelhead by increasing enforcement efforts.

PROGRAMMATIC ACTION 1B: Develop harvest management plans for chinook salmon and steelhead with commercial and recreational fishery organizations, resource management agencies, and other stakeholders to meet target escapement and production goals for the lower American River and American Basin creeks.

PROGRAMMATIC ACTION 1C: Evaluate the efficacy of a marking and selective harvest program for lower American River chinook salmon.

RATIONALE: *Restoring and maintaining populations of chinook salmon and, steelhead, and American shad to levels that make full use of habitat may require restrictions on harvest during and after the recovery period. Involving the various stakeholder organizations in the planning process should help to ensure a balanced and fair allocation of harvest. Target population levels may require that levels of harvest of naturally produced fish be reduced. For populations supplemented with hatchery-produced fish, selective harvesting may be necessary to limit the harvest of wild fish while harvesting hatchery-produced fish at a level that will reduce their potential to disrupt the genetic integrity of wild populations.*

ARTIFICIAL PROPAGATION OF FISH

TARGET 1: Evaluate hatchery production and stocking practices at the Nimbus and Feather River Hatcheries that affect American Basin creeks and the lower American River to reduce the proportion of returning, hatchery-origin chinook salmon and steelhead that stray into non-natal streams (◆◆◆).

PROGRAMMATIC ACTION 1A: Develop a cooperative program to evaluate the benefits of stocking hatchery-reared salmon and steelhead in American Basin creeks and in the lower American River.

TARGET 2: Limit hatchery stocking if populations of salmon or steelhead can be sustained by natural production (◆◆◆).

PROGRAMMATIC ACTION 2A: Augment populations of fall-run chinook salmon and steelhead only when alternative measures are insufficient to permit natural recovery of the populations.

TARGET 3: Minimize further threats of hatchery-reared fish contaminating wild stocks of chinook salmon and steelhead (◆◆◆).

PROGRAMMATIC ACTION 3A: Adopt methods for selecting spawning adults for the hatchery production from an appropriate cross section of the returning adult population available to the hatchery.

PROGRAMMATIC ACTION 3B: Develop a collaborative program to coded-wire tag a representative proportion of all fall-run chinook salmon produced at the Nimbus Hatchery.

PROGRAMMATIC ACTION 3C: Investigate replacing the Nimbus steelhead broodstock with the most genetically appropriate steelhead stock. This could be a native residualized rainbow trout isolated above Folsom Dam (if one exists) or another putative native steelhead stock from within the Central Valley.

RATIONALE: *In watersheds such as American Basin creeks and the American River where dams and habitat degradation, as well as extreme natural conditions have limited natural spawning, hatchery supplementation may be necessary to sustain fishery harvest at former levels and to maintain a naturally spawning population during droughts. Hatchery augmentation, however, should be limited to avoid inhibiting recovery and maintenance of wild populations. Hatchery-reared salmon and steelhead may directly compete with and prey on wild salmon and steelhead. Hatchery-reared fish may also threaten the genetic integrity of wild stocks by interbreeding with the wild fish. Although irreversible contamination of the genetic integrity of wild stocks has occurred, additional protective measures are necessary to minimize further genetic degradation and recovery of wild stocks. Because of the extent of development on the American River, stocking of chinook salmon and steelhead may be necessary to rebuild and maintain stocks to sustain sport and commercial fisheries. Stocking salmon and steelhead may also be necessary on American Basin creeks to build runs to self-sustaining levels and to maintain the runs through adverse conditions such as may occur during droughts.*

Nimbus Hatchery steelhead and naturally spawning fish in the American River exhibit genetic affinity to populations from the Eel River (NMFS 1997), reflecting the origin of this broodstock (McEwan and Nelson 1991). This stock has also been introduced to the Mokelumne River via the Mokelumne River Fish Installation. The feasibility and desirability of phasing-out the Nimbus strain in favor of a stock more genetically similar to the native Central Valley stock should be investigated. The Central Valley Steelhead Comprehensive Genetic Evaluation should be able to identify the most genetically appropriate stock to culture at Nimbus Hatchery, if one exists.

Traditional hatchery stocking programs are detrimental to the recovery of native stocks due to genetic dilution, straying diseases, increased angling pressure, and direct competition. Changes made to

traditional hatchery procedures can result in hatcheries becoming a tool to rebuild native stocks rather than one that degrades them. Decreasing the number of hatchery propagated fish in the Lower American River may increase the opportunity for native stock recovery. However, clear restoration goals for the Lower American River must be developed before the efficacy of such an action can be addressed.

Potential changes at the Nimbus Fish Hatchery that could benefit the river's native stock include: (1) use of all available broodstock, including grilse, to increase genetic diversity of propagated fish. The practice of discarding broodstock under some arbitrary minimum length simple reduced the genetic diversity of hatchery propagated fish, and thus should be discontinued; (2) The emphasis must be placed on quality, not necessarily the quantity of hatchery production. This potentially means improving water quality and reducing densities of fish to create conditions less likely to be conducive to development and proliferation of disease; (3) Nimbus Fish Hatchery should consider treating their effluent waters to further guard against the introduction of new diseases which may impact native stocks. As recommended in the Steelhead Restoration Plan for the lower American River, the Nimbus Fish Hatchery should continue to improve and implement management practices by taking early migrant and late migrant fish for spawning, and randomly selecting egg lots that are to be raised to yearling size.

Annual hatchery operations and release strategies presently include trucking chinook salmon smolts to release sites in the western Delta. This practice was implemented due to the high loss of juvenile salmon released in the American River as they migrated down the Sacramento River and through the Delta. A long-term goal is to reduce the need to truck chinook salmon by increasing their inland survival. This will accomplished by restoration actions proposed for the American River, Sacramento River, and Sacramento-San Joaquin Delta Ecological Management Zones, and by developing and constructing alternative water conveyance facilities in the Delta.

CONTAMINANTS

TARGET 1: Reduce the application of herbicides, pesticides, fumigants, and other agents toxic to fish and wildlife on agricultural lands that have the greatest risk to fish and wildlife populations (◆).

PROGRAMMATIC ACTION 1A: Enter into conservation easements with willing landowners to modify agricultural practices in ways to reduce loads and concentrations of contaminants.

PROGRAMMATIC ACTION 1B: Provide incentives to landowners to modify agricultural or other land use practices that contribute to the input of contaminants into waterways.

RATIONALE: *Reducing the inputs of contaminants into waterways from the lands with the greatest inputs would provide significant improvement in water quality in streams and wetlands, as well as the Sacramento River and Bay-Delta.*

STRANDING

TARGET 1: Reduce or eliminate the stranding of juvenile chinook salmon on floodplains, shallow ponds, and levee borrow areas (◆◆).

PROGRAMMATIC ACTION 1A: Conduct surveys of stranding in the American River under a range of flow conditions and develop recommendations to resolve the problem.

PROGRAMMATIC ACTION 1B: Conduct surveys of stranding in the Natomas area under a range of flow conditions and develop recommendations to resolve the problem.

PROGRAMMATIC ACTION 1C: Develop a protocol for ramping flow reductions so that flows do not recede so quickly that juvenile fish become isolated and stranded in side-channels in large numbers. Identify threshold flows that define conditions of allowable flow fluctuations.

RATIONALE: *Under some flow conditions, stranding is likely a minimal problem. However, under conditions in which rivers reach high flows and water is diverted into the flood bypasses or spills onto the floodplain, and then quickly recedes, stranding is a serious problem. Stranding of juvenile fish has been a significant problem on the lower American River in the past, and has resulted in significant losses of*

salmon and steelhead. Timing also plays a important role in determining the severity of the problem for chinook salmon, flood plain inundation prior to young salmon emerging is less of a problem that inundation after most of the fry have emerged. Juvenile steelhead are present year-round, however, so fish are subject to isolating flows at all times of the year.

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